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A BIOLOGICAL JOURNAL.

VOL. I. JUNE, 1890. No. 4.

NOTES ON THE HETEROSPOROUS FERN ALLIES OF THE PACIFIC COAST AND MEXICO.

BY LUCIEN M. UNDERWOOD.

Recent collectors in western North America have contributed much to our knowledge of the distribution of the fern allies, and in order to further stimulate the search for these inconspicuous forms we present a list of the species represented in our herbarium, with their distribution as known at the present time. We reserve *Selaginella* as the subject of a further paper. Of the others, *Isoetes* and *Pilularia* are least conspicuous and are very likely to be overlooked from the fact that their foliage bears a striking resemblance to sterile grasses, sedges or rushes *(Juncus)*. Indeed, sterile stems of *Eleocharis* and *Juncus* are frequently sent in for species of *Pilularia* and *Isoetes* respectively. It is probable that both genera have a far wider range than is now known. *Marsilia*, more conspicuous and attractive, is more frequently collected; the same is true of *Azolla*, which forms a beautiful covering on the surface of many ponds and ditches.

The following list includes all the species hitherto reported from the region covered; species not represented in our own collection are enclosed in brackets.

ISOETES ECHINOSPORA Dur. VAR. To this variable species we have referred two specimens collected by Prof. Macoun on Vancouver Island, although both differ somewhat from each other and from any of the described forms of this species: Sproat Lake, 1887; flowing water between tides, Alberni, 1887 (Macoun).

[ISOETES PYGMÆA Engelm. So far as we know the only specimens yet found are those of Bolander's original collection (1866) in "a cold Alpine stream on the eastern slope of the Mono pass, California, 7000 ft alt."*]

*Engelmann, The Genus Isoetes in North America, Trans. St. Louis Acad. Sci., iv, 358–390 (1882).

ISOETES BOLANDERI Engelm. Utah: Alta, Wahsatch Mountains, 1883 (M. E. Jones). California: Summit Valley, 1882 (Pringle); Bear Valley, San Bernardino Mountains, 1882 (S. B. and W. F. Parish, No. 1440); Corte Madera, 1887, Donner Lake, 1887, Olema, 1888, (Brandegee). British America: Lake Mara, Sicamous, Kamloops, 1889 (Macoun). Some of the specimens from Olema are enormous for this species, having leaves 20 to 30 cm. long; they grew in water knee-deep. The range of this species is thus considerably extended both north and south. Dr. Engelmann also had it from Wyoming, Colorado and Washington. It has not yet been reported from Nevada, Oregon or Idaho, yet ought to be found in all these states and probably Arizona as well.

ISOETES HOWELII Engelm. Ponds near The Dalles, Oregon, 1880 (T. and J. Howell).

ISOETES NUDA Engelm. Hood River, Oregon, 1882 (Howell).

ISOETES SUKSDORFII Baker. W. Klickitat Co., Washington, 1886; (Suksdorf); in "hog wallows," Carbondale, Amador Co., Cal., March, 1889 (Brandegee). From the California specimens we obtained the following measurements, which were not published in the original description: Macrospores 0.247–0.323 mm. thick, smooth or slightly tuberculate near the converging ridges; microspores oval, 0.023–0.025 mm. long by 0.015 mm. broad.

ISOETES MEXICANA Underw., Bot. Gazette, xiii, 93 (1888). Slow streams at base of Sierra Madre, State of Chihuahua, Mexico, 1887 (Pringle); Sierra de la Laguna, Baja California, alt. 5,000 feet (1890) (Brandegee), two forms, probably depending on station, one growing in water and the other in sand, plants seemingly dioicous; near Santo Tomas, Baja California, 1886, (Orcutt) exceedingly slender specimens, also dioicous. When the form-makers appear this will doubtless pose as *forma gracilis*.

ISOETES PRINGLEI n. sp. Amphibious; trunk bilobed; leaves 10–20, narrow, pale green in drying, 16–25 cm. long, gradually tapering, rather firm, abundantly supplied with stomata; sporangium large (1 cm. long by 6 mm. wide in the largest plant), oval, with a moderately narrow velum; ligule small, triangular; macrospores chalky white, 0.475–0.495 mm. thick, coarsely and densely spinulose, the spines broad but seldom uniting; microspores sulphur-yellow, 0.032–0.040 mm. thick, smooth. Muddy soil near Guadalajara, Mexico, October, 1889 (Pringle, No. 2633). The macrospores

of this species are strikingly like those of *I. echinospora* Dur., but the upright habit, bast-bundles, and the characters of the sporangium are sufficient to distinguish it from even that variable species. In appearance it is not unlike *I. Mexicana*, with which indeed Mr. Pringle confused it in the field; its spore characters, however, readily distinguish it from that species.

ISOETES MARITIMA Underw. Bot. Gazette, xiii, 94 (1888). In a salt marsh, Alberni, Vancouver, 1887 (Macoun).

ISOETES NUTTALLII A. Br. Oregon, 1871 (E. Hall); Southwest Oregon, 1884 (T. Howell); Nanaimo, Vancouver, 1887 (Macoun). Dr. Engelmann reported it also from Washington and Idaho. It should occur in Northern California and doubtless will be found as soon as some one looks for it.

ISOETES ———. Some dry leafless plants were communicated by C. R. Orcutt in 1888, which we are unable to locate with certainty; the microspores are dark-brown, 0.025 mm. thick, slightly muricate; trunk showing a tendency to be three-lobed. Mesas, South Chollas, San Diego, California, 1884 (Orcutt, No. 1242).

So far British Columbia has four species of *Isoetes*, the three Pacific states have each three species, and Mexico, from which no species were known prior to 1887, has now two.

MARSILIA VESTITA Hook & Grev.* Mexico: San Luis Potosi, 1881 (Schaffner); with the two plants of *M. vestita* forming this specimen occurs a third plant larger and sterile, with elongate, upright petioles, which may possibly belong to *M. polycarpa;* Slaven's Ranch, Sonora (Lemmon); San Jorge, Baja California, 1889 (Brandegee) mixed with *M. Mexicana;* Sierra de la Laguna, 1890 (Brandegee). Arizona: Sterile aquatic forms (Lemmon). California: Sierra Co. 1874 (Lemmon); Emigrant Gap (Brandegee); San Diego, 1884 (Orcutt); Del Mar, San Diego Co., 1889 (Brandegee) *mucronata* form. Webber Lake, 1887 (Mr. & Mrs. J. G. Lemmon). Oregon: Grant's, Columbia R. (T. J. Howell); also specimens cultivated by Al. Braun in Berlin from material sent by E. Hall. Washington: Falcon Valey (Suksdorf). British Columbia: Kamloops, 1889 (Macoun). This variable species has also a range from Dakota to Texas and westward. It is especially desirable that the aquatic forms should be

*Other stations of this species from the specimens represented in the Gray herbarium and the Torrey herbarium are noted in Bull. Torrey Club, xiv, 92 (1887).

studied in the field, noting the differences that appear as the water lowers and the plant become terrestrial.

MARSILIA MINUTA Fournier, Bull. Soc. Bot. France, 1880, 329. Morales, San Luis Potosi (Schaffner), hitherto referred to *M. vestita;* Chihuahua, 1886 (Pringle), sterile plants which doubtless belong here; Guadalajara, 1889 (Pringle, Nos. 2424 and 2632, the latter a peculiar growth of plants, showing in natant forms transitions towards *M. picta* Fee). The well-fruited specimens of Mr. Pringle (No. 2434) show this species to be clearly distinct from either *M. vestita* or *M. tenuifolia*, with which it has hitherto been confused.

MARSILIA MACROPODA Engelm. Matamoras, Mexico, 1888 (Pringle, No. 1975). This species had hitherto been found only in Texas and New Mexico.

MARSILIA MEXICANA A. Br. Cusihuiriachic, state of Chihuahua, Mexico, 1888 (Pringle, No. 2007); San Jorge, Baja California, 1889 (Brandegee).

? MARSILIA POLYCARPA Hook & Grev. A sterile plant communicated as *M. picta* Fee, San Luis Potosi, Mexico (Schaffner) and hitherto referred to *M. vestita*, is perhaps a form of *M. polycarpa*, as suggested by Baker.* Leaves with similar sculptured forms (said to be produced by some aquatic animal) are found in natant forms of *M. Mexicana, minuta* and *quadrifolia.*

PILULARIA AMERICANA A. Br. California: Antioch, 1884 (Brandegee); San Diego, 1884 (Orcutt); May, 1889 (Brandegee); Colusa Co., April, 1889 (Brandegee). Mexico: Santo Tomas Mission, Baja California, 1886 (Orcutt). The original station was Santa Barbara,† from whence we have seen no specimens. It is also reported by Prof. E. L. Greene from Suisun.‡ Californian specimens agree well with forms cultivated at Berlin from Chili by Al. Braun. It is doubtless wide-spread, and from its inconspicuous form just as widely overlooked. It will be of interest to know more of its distribution since Nuttall collected it in Arkansas.

AZOLLA CAROLINIANA Willd. California: Santa Cruz Mountains, August, 1888 (Underwood). Arizona: 1887 (Lemmon). Mexico: San Miquelita, San Luis Potosi (Schaffner); Morales, San Luis Potosi (Schaffner, communicated as *A. Mexicana*); Orizaba, March' 1890. (Phila. Acad. Expl. in Mexico, No. 113).

*Handbook of Fern Allies, 139. †Botany of California, ii, 352.
‡Pittonia, ii, 106 (1890).

AZOLLA FILICOIDES Lam. La Honda, San Mateo Co., California, 1890 (Brandegee), the plants so crowded as to stand upright. A larger and coarser plant than *A. Caroliniana*, easily distinguished in fruit by the non-septate appendages to the massulæ. Baker* gives its habitat as "South America, mainly on the west side." This adds another Chilian plant to the Californian flora.

The lists for the various Pacific states may be thus summarized:

California:† *Isoetes pygmæa, I. Bolanderi, I. Suksdorfii; Marsilia vestita; Pilularia Americana; Azolla Caroliniana, A. filicoides* — 7 species.

Oregon: *Isoetes Howellii, I. nuda, I. Nuttallii; Marsilia vestita* — 4 species.

Washington: *Isoetes Bolanderi, I. Suksdorfii, I. Nuttallii; Marsilia vestita* — 4 species.

Arizona: *Marsilia vestita; Azolla Caroliniana* — 2 species.

Mexico:‡ *Isoetes Mexicana, I. Pringlei; Marsilia vestita, M. minuta, M. macropoda, M. Mexicana, M. polycarpa; Pilularia Americana; Azolla Caroliniana;* [*Salvinia auriculata*] — 10 species.

British Columbia: *Isoetes echinospora, I. Bolanderi, I. maritima, I. Nuttallii; Marsilia vestita* — 5 species.

BRODIÆA MULTIFLORA.

BY CARL PURDY.

I have just read Mr. E. L. Greene's treatise on "Some Species Commonly Referred to Brodiæa" published in the Bulletin of the California Academy of Sciences several years since. While there are many points involved in which I cannot agree with Mr. Greene, I will refer to but one at present, i. e., his "Brodiæa multiflora," and his criticism of Sereno Watson's description of that species. It is

*Handbook of Fern Allies, 137.

†This list adds two species to those enumerated in the second volume of the Botany any of California.

‡The last catalogue of Mexican Pteridophytes was that of Fournier in Mission Scientifique au Mexique—Recherches Botaniques: 1re. Partie—Cryptogamie (1872). This list includes *Salvinia*, 1 species, *Azolla*, 2 species, of which one is really a synonym of the other, and *Marsilia*, 3 species, of which one is the doubtful *M. picta* Fee. Fournier added *M. minuta* to the Mexican flora in 1880. The above list adds five more species. All the species now reported have been found by recent collectors, except *Salvinia auriculata* (Tampico), and fruiting forms of *Marsilia polycarpa* (Mesachica).

plain to me that Mr. Greene has never seen the species which Mr. Watson accurately described and which is very appropriately named. His description does not in any way describe the species which Mr. Watson treated, nor does Mr. Greene describe that species under any other name. *Brodiæa multiflora* Benth. is the most clearly marked of all of the species with capitate umbels. Its bulb is very distinct and grows in thin clay soils, in open ground on south hillsides. The bulbs are often less than an inch from the surface. The leaves are broad at base, short and acuminate. The scapes short, a few inches to over a foot, mostly about six inches. The name *multiflora* is suggested by the habit of bearing several scapes from one bulb, a rare occurrence in any related species. It is the first liliaceous bulb to flower, often late in February, at Ukiah.

MEXICAN NOTES, II.

BY W. G. WRIGHT.

A walk along the sand flats of the bay and the edges of the estero, after Cicindelidæ was planned for the next day, and as these low and sometimes muddy places were apparently favorable for this class of beetles, I anticipated a lively and interesting day's work, with abundant spoil as the result. But here again it was the unexpected that happened. Soon after starting I came to a place where a city sewer led its malodorous waters out upon the sands at low tide; here I found and captured two tiger beetles of a dull color, with thin sharp lines upon the elytra—*C. tortuosa.* I passed on thinking to find more and better species farther along, and away from the people who swarmed all about me. Going southward the bay skirts first the low part of the city, and then the large cocoanut grove that looks so inviting to the stranger from on board ship. At this point the lagoon enters the bay, and thence the shore trends eastward with extensive sand beaches and mud flats. It was here that I hoped to find a full harvest of sparkling beetles, but not one was to be seen. Many birds, white egrets, herons, kingfishers, flycatchers, and hundreds quite unknown to me, were all about, flying, sailing and stalking the flats for their breakfasts. A rocky ridge or ledge of loose stones ran out into the flats; here some men were groping about with fingers and toes to get mussels, about an inch across, but very thick. They said they got them to eat. After

that came the endless tideflats again; sometimes wide and level, then again narrow and steeper, sometimes muddy and again sandy, seemingly made on purpose to suit Cicindelidæ, but still no beetles; no use evidently to go any further on that line. So I turned back, and late in the afternoon came again to the sewer, finding there a few more of the same species, so that I got about twenty examples of that one species for the day's work. Not much to be sure, but then the collector must take things as he finds them, the bad days with the good, together. Some boys were near by flying their kites, and, like boys with fairer skins, they soon became interested in my efforts, and at once were anxious to help, being so eager that they would pounce upon the net as soon as a beetle was caught, and generally crush it in their haste; being therefore deprived of that amusement they pushed on ahead, trying to find others, and so alarming the insects that I heartily wished them at home and in bed, only that these boys have no beds to get into. But it was getting late and growing cool, and the beetles became scarcer, so that I gave it up and went home. The Cicindelidæ caught this day were all of this one species, without variation. No other place anywhere about the city, either in damp places or in dry, had any of these insects at all, although some of the warm, dry roads and sandy reaches offered apparently the finest possible places for them, so that I saw no more tiger beetles till I reached the highlands of the interior, where I found *C. Sommeri*, a lovely red-marked species, as will be hereafter related.

The next day opened cloudy, threatening rain, but the sun half shone a part of the time, and I went out hunting on general principles, taking my gun for birds, and plant press along. On reaching the outskirts of the city, a large yellow and black bird was yelling in the coffee bushes; it was a flycatcher; it was also very wary, and led me along half a mile, till at last I shot it in the mangrove swamp. Now, right here I will remark that wherever I went in Mexico, at my elbow was sure to be a native man, woman or child. So at the moment when my yellow and black flycatcher dropped into the water of the swamp, up jumped a smart youngster close behind me who, crying "bueno!" with great emphasis, ran out into the mud with his bare feet and legs to get my bird. He evidently thought it a capital shot, for he kept jabbering away so rapidly that I could not begin to understand him. Then eagerly he pointed out another bird

in the mangroves, and that one also I shot after careful stalking. The boy ran to get it, and brought it in with evident admiration of the stranger's gun. I gave him a medio for wading after the birds, or for his appreciation, perhaps, and then as it was beginning to rain I went home, although the boy tried earnestly to show me more birds. Another day I got in this vicinity several specimens of a wading bird that is called "lagoon bird" by the people. It is glossy brown, has a corneous comb at base of bill, placed across instead of lengthwise as might be expected, and a hooked claw or spine at elbow of each wing; it is quite a showy bird in flight, as the under side of its wings are bright salmon color, and when it alights after a flight it holds its wings erect a moment or two as if purposely to show the lovely color. The use of the formidable spines upon its wings I am unable to surmise, as my observations failed to give any information. The birds were walking about on the aquatic plants feeding, were rather wild and difficult to approach, requiring careful stalking. The bird is a Jacana, I believe. I regret that it is impossible here to give the names of the various objects of interest as I go along, but determinations have not yet been received, especially of the plants, so the technical names must be deferred till the close of these notes, when a complete list will be given, if possible.

The next day was like the preceding, cloudy, and late in the day, rainy. In the morning, with press and gun, I went to the first foot-hill upon the mainland, several miles from the city. These hills are clothed with brush and small deciduous trees, no evergreens being seen. One tree was in bloom with large white flowers which at first I mistook for white-breasted birds; the ground beneath was covered with the fallen blossoms, which apparently last but a day. The limbs were thick and very brittle, almost falling of their own weight. I climbed to get the best flowers for specimens, and narrowly escaped a disastrous tumble, the large limbs breaking without warning. The tree is called "palo blanco,"—white wood—and is so soft and pulpy that a large tree will quite rot away and disappear in a few months, if cut down. Cattle and horses are immoderately fond of the blossoms. In the densest part of this thicket I surprised a pair of large gray night birds, resembling the goat-sucker; a quick shot brought down one, but the other I did not get till another day, when I came purposely after it. I was quite taken aback to come across, in this dense shade and upon a cloudy day,

three of the largest and finest butterfles I had yet seen; they were upon the tree trunks, and as I had no net with me, I could only look and admire, and assure them that I would certainly return and make better acquaintance another day. And it is only fair to anticipate a little, and say that I did return and hunted those butterflies diligently, but never got one of them.

On the return home I got a splendid oriole, much like the northern *bullocki*, only larger; also, one much larger still, black and yellow in color, which must be the most elegant oriole in Mexico. By this time it was raining, and it was a long, muddy road home to my comfortable rooms.

Next day was also unfavorable. A few hardy butterflies were out, and were captured. Quite a lot of new plants found place in my plant press, among them one growing in wet places and looking like a wild oat, but with blue blossoms. I visited the spot four times to get flowering specimens. An *Œnothera* also grew in the wet places close by, and a great lot of Solanums of strange look. To get some "tomatas" growing as weeds in a vegetable garden I intruded upon cultivated ground, when the owner, espying me, advanced rapidly, for he thought I was getting some of his green peas; but when he came near I courteously saluted, and then he was lost in amazement at the queer proceeding of pressing plants, and soon grew enthusiastic, and insisted upon showing me all the curious weeds upon the place. Among them, indigo, a great variety of morning-glories, and the most densely-spined plant I ever met.

Cereus Schottii (?) grows freely in this region, especially in the hills immense trees of it are seen. Curiously enough these big cacti are usually deeply dug about by treasure hunters. Some I have seen nearly uprooted by this digging about the roots, for though every isolated rock or knoll is taken for a sign-post which points to hidden treasures, every hill-top pitted with holes, these large cacti especially are taken as land marks. Upon this subject of treasure-hunting I may, later, have more to say. At present I am trying to say that the smaller limbs or sections of this cactus—pieces six or eight feet long and six inches in diameter—are used to make fences, being set in the trenches like stakes or palisades, where they take root, forming a live fence that is impassable for man, beast or bird. Upon the young growth of this cactus I found the largest beetle I saw in Mexico, a *Curculio*. Some miles of these fences I scanned,

hoping for a mate, but in vain. Then I came to a place where cocoanut palms had been cut down, and the large butt lengths of the stem were lying about on the damp ground. There, I was sure, would be hidden a large lot of *Cychrus* and other beetles that love such places; the logs were 16 to 20 inches in diameter, and had been cut down long enough to become ripe for beetles, so with high anticipations I rolled one of them over, and—nothing! Another, with the same result; and, to be brief, not a beetle was to be found in all the campo.

Near by was a low spot with a little pond of stagnant water covered with an immature Azolla. Around the water were some green grasses; these I swept for beetles, and then snatched them for the herbarium. The little beetles were all small, none so large as half a grain of wheat, most of them being Coccinellidæ and Chrysomelians, some of them under the glass lovely in color and of metallic sheen; and Halticas, just as lively and energetic as they are usually found to be.

A short walk brought me to the ocean beach, and it being low tide I tramped rapidly homeward upon the hard sand of the shore, whereon great numbers of gulls and other sea birds were standing to rest their wings, allowing me to get very close before taking flight.

I reached home late and tired. But no one cares if he is tired if he but brings home full packs of seizures. That evening, too, was Saturday night. A happy week in happy, careless Mexico was ended.

CLASSIFICATION OF DRYOCAMPA RIVERSII.

BY H. H. BEHR.

In Proc. Cal. Acad., 1889, p. 94, I described a new Bombycide and classified it with the Dryocampa type. The insect, which I called *Riversii* in honor of Mr. Rivers, to whom I owe my specimens and notes on their biology, is nearly related to *concinna* Abbott, classified by Dr. T. W. Harris as a Notodonta, and since the publication of *Riversii* I have been enabled to study and more carefully compare the material and in consequence of these investigations my views as to its systematic position have been changed.

I now think the insect in question the American equivalent of the

European genus *Cnethocampa* Steph. included formerly by most authors in *Gastropacha*, but evidently nearer to *Phalera* Hb. and *Pygæra* O. These two last genera have already been separated from the Gastropacha type (*Clisiocampa* Latr., *Lasiocampa* Latr., etc.) by Boisduval, and put into the group of the Notodontides. The genus Cnethocampa, after having been approached by some authors to the Liparides, has lately, on the authority of Lederer, been included in the Notodontides, which I agree with him in thinking is the proper place of this small but interesting genus.

The absence of the tooth-like process on the posterior margin of the forewing of course distances it from the true Notodonta and approaches it to some forms of the somewhat heterogeneous genus, *Edema* Walker. The presence of a disc and a discocentral vein separates the genus entirely from the Clisiocampa as well as the Dryocampa types.

The series of the genera, as far as known to me would be as follows :

PTILOPHORA Steph.— Europe, Australia, Asia?
CNETHOCAMPA Steph.—Europe.
EDEMA (Type *concinna*).— North America.
PHALERA Hb.— Europe, Asia.
PYGÆRA O. (*Clastera* Steph.)— Europe, Asia, North America.
DATANA Walker, etc., etc.— North America.

THE PLANTS OF SANTA CATALINA ISLAND.

With Plates IV and V.

BY T. S. BRANDEGEE.

From San Pedro, the port of Los Angeles, there may be plainly seen, twenty miles away, a mountainous mass standing out from the waters of the Pacific. This, Santa Catalina Island, is about twenty-three miles long, with a trend nearly parallel to the adjacent coast, and is eight miles in its greatest width, though usually much narrower.

Two mountains form the island, which indeed comes near being two islands, for these high ranges, of which the southeastern is much the larger, are joined by an isthmus only about three-fourths of a mile wide and thirty feet above the ocean level. They form together one of the five large islands which, with several smaller ones,

are found along the coast of southern California. The mountains reach a height of between 2,000 and 3,000 feet; their sides are broken by numerous cañons and gulches; and the summits are often somewhat level or rolling. A trail follows the crest, winding along sometimes near the center, but usually nearer the mainland side. The cañons sometimes widen into small level "parks," but ordinarily they are narrow and the slopes are very steep. Water can be found in most of the larger ones, especially during the early part of the year, though it seldom finds its way to the ocean along the surface. There are some small lakes situated high up in the mountains; the largest one, known as "Echo Lake," having an area of about two acres, and, occupying what seems to be the crater of an extinct volcano, is filled by the winter rains, and does not often become dry in summer.

The island has for many years been inhabited by sheep and goats, about 12,000 of the former and more than half as many of the latter occupying it at the present time. During the many years these flocks have roamed over its hills many plants must have disappeared from the island flora, especially in seasons of great drought, and doubtless some of those now most common owe their presence to importation by the sheep. At Avalon, a summer resort, which has many permanent residents and is the landing place of the ferry from San Pedro, many of the common needs of the mainland have been recently introduced, and probably more will soon follow.

Few trees but many large bushes are found upon the island; only the poplar, willow, and perhaps an oak reach a size that warrants them in being called trees, and they are hidden in the narrow cañons. Bushes, however, grow almost everywhere, but most luxuriantly upon the northern exposures of the steep slopes, where they often seem to be too large for bushes, though too small for trees. There is a tradition that at one time pines grew upon the island but were destroyed by fire. One of the old inhabitants, however, a man who has lived there for thirty-four years, says there was no trace of them at the time of his arrival.

The flora, as a whole, very much resembles that of Santa Cruz Island, and at first sight appears to differ from it only in the abundance of *Crossosoma* and *Rhus laurina*. The species, as will be noticed, are to a great extent those of the adjacent mainland. The peculiar species of this as well as of the other islands are largely

southern, and the greater portion of them will probably be found in northern Baja California when that region shall have been thoroughly explored. In a previous* paper it was remarked that the floras of Magdalena and Margarita islands were more northern than that of the adjacent mainlands. These variations from the mainland distribution are apparently the effect of the insular condition which moderates the extremes of temperature and tends to produce a warmer mean temperature in the northern and a cooler in the southern islands than that of their respective adjacent mainlands.

Within the last few years, Mr. W. S. Lyon has spent some time upon Santa Catalina as well as on San Clemente, and made considerable collections, publishing the results with notes upon previous collectors and most interesting descriptions of the islands in the Botanical Gazette of August and December, 1886. His list of Santa Catalina plants contains one hundred and fifty species and notes, concerning a few of them may be of interest.

CROSSOSOMA CALIFORNICUM Nutt. Grows to a height of ten feet or more, and is quite showy with its numerous white flowers. Mr. Vaslit says† the carpels are often as many as six and sometimes seven. I have frequently found as many as nine. A species very closely allied, if not too near, is found in the San Bernardino Mountains, and is very abundant in Lower California, below San Quintin.

LAVATERA ASSURGENTIFLORA Kell. This was not included by Mr. Lyon in his list, but was mentioned in the introduction as growing luxuriantly upon Bird Island, said to be distant from Santa Catalina two miles. I found it growing upon a small rock or island near the isthmus and much nearer the main island. The rock has a very small area of shallow earth upon it, and but a few depauperate specimens which had already lost most of their leaves grow there in the nearly dried out soil. It was reported as growing luxuriantly upon an islet, perhaps the one visited by Mr. Lyon, northwest of this one. The local name of the plant is "Malva rosa." The species was described from a cultivated specimen obtained by Dr. Trask from a garden in Santa Barbara. The seed he was told came from the island of Anacapa, which, properly speaking, is the broken off rocky tail of Santa Cruz. It has not since been reported from the original locality, but has been found on San Miguel, San Cle-

*Proc. Cal. Acad., ser. 2, ii, 120.

†Zoe i, 27.

mente, and various islets and rocks about Santa Catalina and Santa Cruz. Dr. Gray says† that it is nearly allied to *L. acerifolia* and *L. phœnicia* of the Canary Islands. Like them it loves the sea, and it is extensively planted near San Francisco by market gardeners as a wind-break to protect their tender vegetables from the sharp sea winds. Though so abundant and so widely spread in cultivation, it has never, so far as known, become naturalized on the mainland, and if it ever does so will probably inhabit the rocky cliffs of the southern coast.

The four species described from various islands off the coast of California and Baja California—*L. assurgentiflora; L. insularis* from Coronados Islands, near San Diego; *L. venosa* from San Benito; and *L. occidentalis* from Guadalupe—are all very closely related, and the differences, slight as they are, seem not to be constant. Specimens of *L. assurgentiflora* from San Miguel have a papillose, densely pubescent calyx; petals pubescent within and the villous tufts usually found at each side of the base meeting in front; the sides of the carpels only slightly veined. Specimens from a small rock scarcely a mile from the shore of Santa Catalina have much less of the stellate pubescence, the calyx enlarging and becoming thin in fruit. The fruit of plants growing about San Francisco is smaller; the carpels strongly veined; the calyx papillose, stellate pubescent and little enlarged in fruit. The division of the involucel is variable in degree. *L. venosa* (which I have not seen) appears to agree with this species in the villous bases of the petals, and the venation of the sides of the carpels. *L. occidentalis* and *L. insularis* appear to be nearly identical.

CEANOTHUS SOREDIATUS Hk. & Arn. of Mr. Lyon's list has been since described as a new species — *C. arboreus* Greene. On this island it is a large bush, and was in full bloom from new wood, a common circumstance in the coast forms of Ceanothus, which in such localities flower continuously for a considerable period. The resemblance between this plant and specimens of *C. azureus* from northern Mexico (Pringle's No. 2,533) is most striking.

RHUS DIVERSILOBA T. & G. More variable than on the mainland, the most noticeable form often having five leaflets (Pl. iv, fig. 2).

†Bot. Cal. i, 83.

RHUS INTEGRIFOLIA B.&H. Mr. Lyon mentions a peculiar ternate-leaved form. The ternate leaves are usually scattered among those of the usual shape, and no bush with any large proportion of the abnormal ones was seen (Pl. iv, figs. 3–7).

RHUS LAURINA Nutt. The leaves of this species occasionally show a tendency to become pinnately divided. The abundance of Rhus is noticeable.

HOSACKIA GLABRA Torr. Growing usually in the slender clustered form of the main-land, but sometimes with a considerable elongation of the woody base, when it becomes *S. dendroideum* Greene.

PRUNUS ILICIFOLIUS Walp. Mr. Lyon's list gives also *P. occidentalis* Nutt., but both forms must belong to the same species, and "Nutt." is probably a misprint for Swartz,* who described a *Prunus occidentalis* from the West Indies. The leaves are usually more entire than the Santa Cruz Island forms. Curiously enough the island form, with longer, more pointed and less dentate leaves, is found in the cañons of the mountains of Baja California.

HETEROMELES ARBUTIFOLIA Rœm. Common and often forming groves in the manner of Lyonothamnus.

LYONOTHAMNUS FLORIBUNDUS Gray. This remarkable plant, described by Dr. Gray from specimens collected in the northwestern part of the island and dedicated to its discoverer, furnishes a notable illustration of the variation of leaves. In the groves first seen they were long, slender and usually entire, but near the head of Swain's Cañon two groves of considerable extent are found, the lower one of which furnishes divided as well as entire leaves (Pl. v, figs. 1–7). These approach far too nearly *L. asplenifolius* Greene (figs. 8–13) from Santa Cruz and Santa Rosa islands, which was separated from the first on the form of the leaves alone. They differ in no respect in flower or fruit, grow alike in groves upon the slopes of cañons, have the same form, the same pubescence, the same shreddy bark, and the stipules which Dr. Gray supposed to be better developed in *L. asplenifolius* prove to be equally so in the first, and now the connecting forms of leaves make it certaín that they are but variations of a single species. It would be as reasonable to consider a bush of *Rhus integrifolia*, with ternate leaves, a distinct species as to give that rank to the Santa Cruz *Lyonotham-*

*Prod. Fl. Ind. Occ., 80.

nus. The tree is not abundant on Santa Catalina and may easily disappear. Mr. Harry Polley, who knows it well and is familiar with the whole island, says there are but four groves upon the larger and less than six upon the smaller part. Its nearest relative *(Vaquelinia)* grows in Baja California, and if *Lyonothamnus* itself is ever found on the mainland it will probably be in the unexplored mountains of that region.

GALIUM CATALINENSE Gray. Specimens of *G. buxifolium* Greene have been compared with the original of this, and found to be the same. It is abundant and varies in size and pubescence.

ARCTOSTAPHYLOS BICOLOR Gray, grows to be very large, sometimes reaching a height of twelve feet. Its observed habitat on the mainland is from Encinitas in San Diego county well down into Baja California.

ANTIRRHINUM SPECIOSUM Nutt. This plant and *A. junceum* Benth., form, according to Dr. Gray, a section *(Gambelia)* in the above genus. It is rather remarkable that each of them should have been taken as the type of a genus; the first being *Gambelia speciosa* Nutt., the second (first described as *Maurandia juncea* Benth.), *Saccularia Veatchii* Kell. In habit they are very dissimilar, but the flowers in form and color, as well as the fruit, are much alike. The corolla of *A. speciosum* is shorter and broader, and the projecting palate (which nearly closes the throat in each) is smooth. The palate of *A. junceum* is hairy, and a broad pubescent line extends from it to the base of the tube. In *A. speciosum* this pubescent line begins only at the lower third of the tube. The rudiment of the posterior stamen was present in all the flowers of *A. speciosum* examined and all the mainland *A. junceum*. The seeds are irregularly oblong, and covered with longitudinal rows of soft, unequal, considerabiy elongated papillæ.

MIMULUS GLUTINOSUS var. PUNICEUS Gray. Plants with salmon colored flowers are abundant, growing in company with the red-flowered ones.

SCROPHULARIA CALIFORNICA Cham., seems quite different from the well-known mainland form, on account of the development of long, spreading white hairs, especially abundant on the panicle, giving it a really handsome appearance. Forms connecting it with the ordinary glabrous one are found both on the island and the mainland.

CASTILLEIA FOLIOLOSA H. & A. Plants as tall, as woody and as white as *C. hololeuca* Greene of Santa Cruz, the pubescence that of the form common on the mainland which on the bluffs about Del Mar in San Diego county grows equally tall and stout.

The following list contains only such species as were not noted by Mr. Lyon. The writer is under many obligations to the resident botanist of the island, Mrs. S. A. P. Wheeler, who, previous to his arrival, had collected many of the species mentioned below; and to Mr. Harry Polley, not only for information concerning plants and the topography of the island, but also for his unwearied assistance in the field:

Ranunculus hebecarpus H. & A.
Delphinium sp.
Platystemon Californicus Benth.
Meconopsis heterophylla Benth.
Viola pedunculata T. & G.
Thelypodium laciniatum Endl.
Sisymbrium canescens Nutt.
Sisymbrium reflexum Nutt.
Brassica nigra Boiss.
Brassica campestris L.
Lepidium nitidum Nutt.
Lepidium lasiocarpum Nutt.
Thysanocarpus laciniatus Nutt.
Silene antirrhina L.
*Silene conoidea** L.
Arenaria Douglasii T. & G.
Tissa marina L.
Polycarpon depressum Nutt.
Claytonia perfoliata Donn.
Calandrinia caulescens HBK. var. *Menziesii* Gray.
Malva borealis Wallm.
Geranium Carolinianum L.
Ceanothus crassifolius Torr.
Vitis Californica Benth.

Lupinus Chamissonis Esch.
Lupinus micranthus Dougl.
Lupinus hirsutissimus Benth.
Lupinus truncatus Nutt.
Lupinus concinnus (?) Agh.
Trifolium Macræi H. & A.
Trifolium amplectens T. & G.
Trifolium Palmeri Watson.
Trifolium tridentatum Lindl.
Hosackia Purshiana Benth.
Hosackia brachycarpa Benth.
Hosackia strigosa Nutt.
Astragalus nigrescens Nutt.
Vicia exigua Nutt.
Tellima affinis Gray.
Tillæa angustifolia Nutt.
Cotyledon lanceolata B. & H.
Eulobus Californicus Nutt.
Godetia Bottæ Spach.
Godetia quadrivulnera Spach.
Godetia epilobioides Watson.
Mentzelia micrantha T. & G.
Cereus Emoryi Engelm.
Opuntia prolifera Engelm.
Mesembryanthemum nodiflorum† Haw.

*S. *quinquevulnera*, reported from Santa Cruz Island and doubtfully identified from insufficient material, is probably the same.

†Abundant near the isthmus, as much or more so than at San Diego, where alone or in company with *M. crystallinum*, it covers the railway embankment for miles.

Bowlesia lobata Ruiz. & Pavon.
Daucus pusillus Michx.
Sanicula laciniata H. & A.
Apiastrum angustifolium Nutt.
Lonicera hispidula Dougl.
var. *subspicata* Gray.
Galium Nuttallii Gray.
Pluchea borealis Gray.
Baccharis Douglasii DC.
Baccharis viminea DC.
Antennaria margaritacea Benth.
Gnaphalium Sprengelii H. & A.
Gnaphalium palustre Nutt.
Ambrosia psilostachya DC.
Franseria bipinnatifida Nutt.
Achyrachæna mollis Schauer.
*Perityle Emoryi** Torr.
Baeria gracilis Gray.
Jaumea carnosa Gray.
Eriophyllum confertiflorum Gray.
Eriophyllum Neviniit Gray.
Anthemis cotula‡ L.
Artemisia vulgaris L.
Senecio Lyoni§ Gray.
Silybum Marianum Gaertn.
Microseris Lindleyi Gray.
Microseris linearifolia Gray.
Rafinesquia Californica Nutt.
Sonchus asper Villars.
Sonchus tenerrimus L.
Specularia biflora Gray.
Arctostaphylos diversifolia Parry.
Anagallis arvensis L.
Dodecatheon Meadia L.
Gilia dianthoides Endl.
Gilia Nevinii Gray.
Gilia glutinosa Benth.
Gilia viscidula Gray.
Nemophila aurita Lindl.
*Nemophila racemosa*** Nutt.
Phacelia distans Benth.
Phacelia grandiflora†† Gray.
Phacelia viscida Torr.
Amsinckia intermedia F. & M.
Amsinckia lycopsoides Lehm.
Amsinckia tessellata Gray.
Krynitzkia intermedia Gray.
Krynitzkia microstachys‡‡ Greene.
Pectocarya penicillata A. DC.
Dichondra repens Forst.
Cuscuta Californica Choisy.
Nicotiana Clevelandi Gray.

*These specimens from Santa Catalina Island are one to two feet high, the akenes entirely awnless, and, compared with specimens from San Quintin and from the Mojave Desert, differ in no particular except size. The odor developed by boiling seems quite the same in each.

†Called "Dusty Miller" by the residents of the island, and conspicuous on the rocky sea-cliffs.

‡One of the recent introductions by way of Avalon, where it is very large and abundant.

§Described from San Clemente, where it was discovered by Mr. Lyon, and since found by Dr. Palmer on the mainland, near San Quintin, Lower California.

**Collected also by Dall and Baker.

††Growing in cultivated or burned over ground, as is often the case on the mainland.

‡‡Extremely variable not only as to the size of the plant, but as to the size of the calyx.

Datura meteloides DC.
*Lycium Richii** Gray.
Linaria Canadensis Dum.
Antirrhinum strictum Gray.
Mimulus brevipes Benth.
Orthocarpus purpurascens Benth.
Aphyllon tuberosum Gray.
Salvia Columbariæ Benth.
Plantago maritima L.
Abronia maritima Nutt.
Lastarriæa Chilensis Remy.
Atriplex decumbens Watson.
Atriplex leucophylla Dietr.
Chenopodium album L.
Chenopodium murale L.
Chenopodium Californicum Watson.
Salicornia ambigua Michx.
Suæda Torreyana Watson.
Euphorbia dictyosperma F. & M.
Euphorbia serpyllifolia Pers.
Houttuynia Californica B. & H.
Allium serratum Watson.
Bloomeria aurea Kell.
Brodiæa capitata Benth.
Brodiæa minor Watson.
Chlorogalum pomeridianum Kunth.
Phyllospadix Torreyi Watson.
Juncus Balticus Dethard.
Juncus robustus Watson.
Eleocharis palustris R. Br.
Carex sp.
Phalaris Canaẓiensis L.
Polypogon Monspeliensis Desf.
Agrostis canina L.
Agrostis exarata Trin.
Muhlenbergia gracilis Trin.
Stipa eminens Cav.
Aristida bromoides HBK.
Monanthochloe littoralis Engelm.
Lamarckia aurea Moench.
Distichlis maritima Raf.
Poa annua L.
Festuca Myurus L.
Festuca tenella Willd.
Bromus Hookerianus Thurb.
Bromus ciliatus L.
Bromus rubens† L.
Lepturus paniculatus Nutt.
Lolium temulentum L.
Agropyrum repens Beauv.
Polypodium Californicum Kaulfuss.
Polypodium Scouleri H. & Grev.
Cheilanthes Californica Mett.
Pellæa andromedæfolia Fée.
Aspidium rigidum Swartz.
Chara sp.

[Plates IV and V, accompanying this article, are artotype reproductions of the leaves themselves, one-fourth the natural size.

Plate IV, figs. 1–2, *Rhus diversiloba.*
3–7, *Rhus integrifolia.*

Plate V, figs. 1–7, *Lyonothamnus* (Santa Catalina).
8–13, *Lyonothamnus* (Santa Cruz).]

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*Described as *L. Hassei* in Pitt. i, 135. A single large clump which grows in the village of Avalon appears to be the only one known in California. Below San Quintin it is common, and grows equally as large. On Santa Catalina it was first collected by Dr. H. E. Hasse and afterwards by Mrs. Wheeler.

†This and one or two other grasses were determined by Dr. George Vasey.

SONG BIRDS ABOUT SAN FRANCISCO BAY.

BY CHAS. A. KEELER.

The purpose of the present paper is to note the birds commonly in song in the vicinity of San Francisco Bay during each season, with remarks on any points of special interest in their songs. The notes on which the paper is based have been made almost exclusively in the vicinity of Berkeley, Alameda county, although some observations have been made at various other points. Twenty-eight species of birds have been recorded in song about the bay, of which number four are heard nearly the entire year. Of the remaining species two are seldom heard except during the winter months, eleven sing only in spring or during the latter part of winter, eight sing exclusively in summer, and two throughout the spring and summer.

During the early part of winter bird-songs proper are never, or at least very seldom heard, and even the species included in the list of those singing all the year are silenced. The first song heard in winter is the sweet flute-like strain of the western meadow-lark *(Sturnella magna neglecta)*. Its song is generally heard for the first time in the latter half of December on the bright mild days which usually occur then. It sings only cccasionally at this time, but a month later is heard much more frequently, while in February the air is filled with its notes rising from every field and pasture. The morning hours are its favorite time for singing, generally before nine o'clock, although it may be heard at all hours of the day. It has several distinct songs, one of the most common of which may be represented by the syllables, "Twee—twedle–tee–te–twe."

Early in January the wren tit *(Chamæa fasciata)* begins to sing. Its note is high-pitched but melodious, and, as I have elsewhere mentioned, is well represented by the syllables, "Tit′, tit,′ tit,′ t-r-r-r-r-e." It is sometimes heard in the early part of the winter, especially in November. At this time the full song is quite rare, the trill being omitted. This song may be represented as follows, "Tit′—tit-tit-tit." In Ross Valley, Marin county, I have heard the full song in December. During the spring months the song of this bird is one of the characteristic notes in the cañons. It sings throughout the heat of summer and even late in the fall. In spite

of the fact that bird-songs are so seldom heard in early winter, there is one species which does occasionally sing at this season. Samuel's song sparrow *(Melospiza fasciata samuelis)* is one of the few birds that sing more or less in every month of the year. It is quite frequently heard in November, very rarely in December, more frequently in January, while in February it is in full song. I am unable to detect the slightest difference between the songs of this variety and of its Eastern counterpart.

There is one bird which occasionally favors us with a song, during the winter months, which far surpasses the vocal powers of the species previously considered. This is Townsend's sparrow *(Passerella iliaca unalaschcensis)*, which is the rarest as well as the sweetest of our winter songsters. Its song, which is loud, rich and varied, is heard only on warm, spring-like days in winter, and the bird remains so secluded while singing that it was some time after first hearing it before I ascertained positively from what species the notes came. I have heard it sing but three times, and consider it quite unusual for this latitude.

It is unnecessary to consider the songs of Gambel's white-crowned sparrow *(Zonotrichia leucophrys gambeli)* and the golden-crowned sparrow*(Z. coronata)*, both of which have been described in a previous paper. In addition to these, the house finch *(Carpodacus mexicanus frontalis)* is the only remaining bird commonly in song during the winter months. During December its song is rarely heard, although I have noted it on one or two occasions, but in January the birds begin to sing again, and by February they are in full song. The well-known habit of this bird of singing on the wing enhances the effect of its note, which sounds like a wild rapturous gush of bubbling melody borne on the wind as the little songster flits by.

At the beginning of spring the Oregon junco *(Junco hyemalis oregonus)* is frequently heard. Its song, which is usually heard in the latter half of February, is a modest little warble. It has two other notes, first its ordinary chirp or twitter, which is the usual call note and cry of alarm, and second a fine, high, squeaky note, sounding singularly like the note of Anna's hummer *(Trochilus anna)*.

The Western robin *(Merula migratoria propinqua)* very rarely sings in the vicinity of San Francisco Bay, but it is occasionally

heard in March, a short time before the birds leave for their breeding grounds. The song is indistinguishable from that of the Eastern bird.

If Bryant's sparrow *(Ammodramus sandwichensis bryanti)* can be said to have a song, it utters it during the latter half of February and in March. Perched on a fence or telegraph wire near the bay shore, the bird utters a queer wheezy attempt at a song, which makes one think the performer must have a severe cold.

By the first of March or a little earlier the green-backed gold finch *(Spinus psaltria)* begins to sing. Its song is a very pleasing, rapturous, canary-like burst of bird music, frequently uttered while the bird is on the wing, although this habit is by no means so characteristic of this species as of the house finch. The bird sings all spring very commonly, and to a less extent throughout the summer, while even in the autumn its song is sometimes heard.

The California shrike *(Lanius ludovicianus gambeli)* is a bird which we would never think of as a songster. It has a song, however, which I have heard uttered on at least two occasions, once in the early spring and again in fall. It corresponds to the song ascribed to the butcher bird *(Lanius borealis)* rather than to the note of the white-rumped shrike *(L. ludovicianus)*. On February 16, 1888, a mild spring-like day, a shrike was seen on a telegraph wire, warbling apparently to itself, as no emotion was shown, and its mate was not in sight. Again on October 18, of the same year, a shrike on a telegraph wire uttered a low liquid trill, frequently repeated and very sweet. While watching the bird an American pipit *(Anthus pensilvanicus)* flew overhead, uttering its call note, and the shrike responded with a very good imitation.

The lutescent warbler *(Helminthophila celata lutescens)* is not so early a singer as most of the species hitherto considered. Its song begins in the latter half of March and continues throughout April. It is a simple high-pitched trill, somewhat resembling the song of the chipping sparrow *(Spizella socialis)*. The Oregon towhee begins singing about the last of March and continues for only about a month. The song consists of a short trill, usually terminated by a wheezy note. It is one of the poorest of our songsters. Among the April singers the note of the rufous crowned sparrow *(Peucæa ruficeps)* may occasionally be heard from the *Artemisia* hillsides, although it is quite a rare bird in this vicinity. I have never de-

tected its song except in April. The plain-crested titmouse (*Parus inornatus*) also sings during April as well as throughout the two succeeding months, but its song proper, which is a simple lay, is much less common than its unmusical call note. The bicolored blackbird (*Agelaius gubernator*) is another April singer. Its note, though a trifle monotonous, is a very pleasing flute-like strain, which may be represented by the syllables, "Twid-dle did-dle did-dle did-dle," rapidly repeated. Vigors's wren (*Thryothorus bewickii spilurus*) begins singing during March and continues throughout April. He has a great variety of notes and can make a surprising amount of noise for so small a bird, but his music does not compare with the merry, rattling song of Parkman's wren (*Troglodytes aedon parkmanii*), which begins singing in March and continues in full song throughout April and May.

At some time during the month of April nearly all our summer singers proper begin to sing. These are the Western lark finch (*Condestes grammicus strigatus*), warbling vireo (*Vireo gilvus*), Western chipping sparrow (*Spizella socialis arizonæ*), lazuli bunting (*Passerina amæna*), summer warbler (*Dendroica æstiva*), black-headed grosbeak (*Habia melanocephala*), Bullock's oriole (*Icterus bullocki*), and russet-backed thrush (*Turdus ustulatus*). All of these birds are in full song in May and June, and are heard more or less in July. The thrush, which begins a little later, sings in August, but it is but a remnant of his divine summer song. A few of the spring singers have an autumn revival of song. Besides the wren tit and Samuel's song sparrow, which are in song constantly, the autumn singers are the Western meadow lark, house finch, green-backed goldfinch, Gambel's white-crowned sparrow, and Parkman's wren. There are a few species sometimes heard in song about the bay which have been omitted from this list, owing to lack of notes. The California thrasher (*Harporhynchus redivivus*) doubtless sings about the southern part of the bay, where it breeds, but I have never heard its song about here. The pileolated warbler (*Sylvania pusilla pileolata*) sings occasionally during migrations, especially in the spring, and some of the other warblers may sing at the same time. The present list does not pretend to include any species that are not resident at some time of the year in this vicinity.

The following table indicates the months in which each species

sings. One asterisk placed near the center of a column shows that the species sings occasionally during the entire month. If the asterisk is placed to the right, the species sings only during the latter half of the month. When two asterisks are placed in a column, the bird sings commonly all month, while three asterisks represent the month when the bird is singing continuously and in great numbers—in other words, the climax of the song period.

	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
Red-winged Blackbird				**								
Bullock's Oriole				**	***	**	**					
Western Meadow Lark	*	**	***	*	*				**	*	*	
House Finch	*	*	**	*	*	*			**	*	*	
Green-backed Goldfinch		*	**	*					**			
Bryant's Sparrow		*	**									
Western Lark-finch				**	**							
Golden-crowned Sparrow	*	**	**	*								
Gambel's White-crowned Sparrow		**	**	**	**	*			*			
Western Chipping Sparrow				**	***	**						
Rufous-crowned Sparrow				**								
Samuel's Song Sparrow	*	**	***	*	*	*	*	*	*	*	*	*
Oregon Junco		*										
Townsend's Sparrow	*											
Oregon Towhee			*	**								
Black-headed Grosbeak				*	**	**	*					
Lazuli Bunting				*	**	*	*					
Gambel's Shrike		*								*		
Warbling Vireo			*	**	**	*	*					
Lutescent Warbler			*	**								
Summer Warbler				**	**	*	*					
Parkman's Wren			*	***	***	*				*		
Vigors's Wren			*	*								
Plain-crested Tit				*	*	*						
Wren Tit	**	**	**	*	*	*	*	*	*	*	*	*
Western Robin			*									
Russet-backed Thrush					***	***	**	*				

ANNUAL MIGRATIONS OF THE DEER OF THE SIERRA NEVADA.

BY L. BELDING.

A small proportion of the deer of central California live constantly in the chapparal belt and foothills of the Sierras, but the most of them ascend the mountains as spring advances, and a part of them, like our mountain quail, go over and beyond the summit and spend the summer on the east slope, where they remain until food becomes scarce or cool weather warns them that it is time to return to the milder climate on the west side. Sometimes heavy early snow-storms find them still on the east side of the mountains, as was the case about Lake Tahoe, October 7, 1889. On this occasion they started for California as soon as the storm was over, leaving ground that was covered with only about six inches of snow, to make an ascent of 2000 feet or more through snow that was much deeper.

There is no doubt that some individuals have their favorite summer resorts, where they were, perhaps, born, and probably all have them and are thoroughly acquainted with the routes leading from their winter ranges to their summer homes, though some of these routes are not less than a hundred miles long. I know of a doe having lived in and near certain thickets at Big Trees during six or seven successive summers, each summer giving birth to fawns, and I think the offspring, like the mother, clung tenaciously to the same locality, but I cannot say positively concerning the progeny. There could be no mistake as to the doe, as she was crippled. She was known to many persons as the club-footed doe. Mr. Harvey Blood of Alpine County told me a young fawn was caught at the Dardanelles, near the Summit, about 8000 feet above sea-level, given the ear mark of the sheep-owner upon whose range it was caught, and then released, and that it was killed the following summer within two hundred yards of the spot where it was branded. The great depth of the snow at this height in the mountains would prevent this fawn from living there more than about a third of the year; the remainder of the year it necessarily being at least fifty or sixty miles down the west side of the Sierras. Perhaps it made the vertical migration alone, as the juveniles migrate later than the adults, usually in pairs, but often singly.

Cattle and sheep which are pastured in summer in the high Sierras also make voluntary vertical migrations from their winter feeding

grounds in the valleys to their summer ranges in the mountains, sometimes in small parties, sometimes singly, and owners of these animals say they manifest much uneasiness and are held with difficulty when the time approaches for the spring drive. The first cool storm in fall is likely to start them down the mountains to their winter ranges again. They sometimes make a considerable part of these journeys during the night.

NOTES ON THE NATURALIZED PLANTS OF SOUTHERN CALIFORNIA, III.

BY S. B. PARISH.

Some additions to our naturalized flora might reasonably be expected from Chinese sources. These people began to arrive soon after gold was first discovered here, and have penetrated to all parts of the state; they are largely engaged in occupations connected with the soil, as gardening, mining and grading; they camp along the lines of new railways, and occupy the neglected outskirts of towns, and wherever they may be they are supplied with many articles imported from their native country. Under these favoring conditions doubtless some Asiatic plants have escaped here and there, yet there has been recorded only a single species,* a grass which was perhaps a mere waif.

Among the plants most likely to reach us through these influences *Sagittaria Chinensis* is to be expected. Its tuberous roots are used as an article of diet, and always occupy a prominent place in the collection of strange delicacies which the Mongolian grocer sets forth to tempt the appetites of his customers. As sold they are in an entirely fresh state, and if planted in damp soil grow as readily as a potato.

Last summer for the first time I found this *Sagittaria* growing on the banks of Warren Creek, a stream which flows by the "Chinatown" of San Bernardino. There were two clusters at places about a mile apart. Each consisted of some twenty or more plants, and had probably established themselves the year before. The severe floods of last winter covered one of these stations under a sand-bar, while the other was ravaged by Chinamen, but despite these drawbacks plants have reappeared this summer at both places, as well as at in-

**Ischæmum leersioides.* Bot. Cal., ii, 262.

termediate ones, where they seem quite at home, and may be fairly included among our exotic plants. Apparently they are an introduction not to be regretted. Their handsome sagittate leaves and white flowers are a pleasing addition to the vegetation of the brooksides, and the tubers may be of some economic value.

The bright little pimpernel (*Anagallis arvensis*), which has spread nearly around the world, is increasingly common with us. In the books it is said to prefer dry and sandy soils, but here it is most abundant and vigorous in the heavy adobe of damp meadows. The usual form is red-flowered, but at Fallbrook, near San Diego, Mr. Cleveland has collected it with blue flowers.

None of the European mulleins so widely naturalized on the Atlantic side of the continent have yet appeared on this, but an additional species, *Verbascum virgatum*, not elsewhere known in the United States, occupies a limited region near Pasadena, in Los Angeles County. It is to be found at the old Dalton Ranch and in abundance under open groves of oaks on the hills about Lamanda Park, where it often attains a height of six feet. Its introduction was probably by way of Mexico, and during Mexican rule.

Hoarhound, *Marrubium vulgare*, infests every roadside throughout the settled valleys of the southern counties, and extends well up the slopes of the arid foothills. Yet although now so omnipresent, there is some reason for believing that it was rather scarce at the time of the American settlement of the country. Old inhabitants tell of seeking it and bringing home roots to plant, so that it might be at hand for use as a domestic remedy, a precaution its present abundance would render needless. Last summer local newspapers reported a carload of the dried herb exported eastward.

The introduction of *Datura Tatula* is directly traceable to the estimation in which its leaves are held as a remedy for asthma. More than twenty years ago a sufferer from this disease planted the seed near Kehl's Mill, and the plant still continues to propagate itself at that place. In that length of time it has spread over only about an acre of ground, and does not seem disposed to extend its limits, although the adjoining land is equally adapted to its growth.

Physalis æquata, a Mexican member of the same order, is widely diffused, being an abundant weed in orchards and gardens, where in rich soil it forms a stout plant three feet high. As it is unarmed it is less obnoxious than some other solanaceous species. Such a one is

Solanum rostratum, whose horned spinescent leaves and fruit make it one of the most pestilent of weeds. Unhappily it has obtained at least a start at the salt works in Los Angeles county, where it was collected some six years ago by Rev. J. C. Nevin. I have not been able to learn how well established it then was, or what has been its subsequent progress, but there is reason to fear that only time is needed for its general dissemination.

The Solanaceæ also furnish one of the two ligneous members of our exotic flora. This is *Nicotiana glauca*, a soft-wooded shrub or small tree of from ten to fifteen feet in height, which is common in waste places wherever the soil is sufficiently damp. It produces throughout the most of the year an abundance of yellow tubular flowers, and it is believed to have been originally cultivated as an ornamental shrub at the Spanish ranches and missions, and to have escaped thence. A native of Buenos Ayres, it has long been naturalized in various parts of Mexico, whence we derive it.

To similar cultivation and escape is also to be attributed the introduction of the castor bean, *Ricinus communis*, the only other non-native shrub of the region, although it is sometimes grown as a field crop, from which escapes also originate. These, however, are less robust and shorter lived than the ornamental forms. It is found in like places with the Nicotiana and reaches the same dimensions, but generally shows a more tree-like manner of growth. Along the Santa Ana River, near Anaheim, there are considerable thickets of this plant. As it is unable to endure a temperature much below the freezing point, the presence of well-grown castor trees is a good indication that the place in which they are found has not been exposed recently to severe frosts.

Catnip, *Nepeta Cataria*, a common herb in the Atlantic States, is apparently quite rare on the Pacific side of the continent. It was not known to occur in California when the botany of the Geological Survey was published, and I have seen no notice of it in more recent papers. It is, however, quite probable that it may be more common than these facts indicate. I first saw it in 1872, growing abundantly near an old farm house at Edgar Cañon, in the San Bernardino Mountains, and I have since seen a few plants near the town of San Bernardino. About the latter place, Spearmint, *Mentha viridis*, is beginning to be frequent by the side of ditches and on damp banks. Usually an escape from cultivation in its

origin, it has in many cases passed from that category, and has become thoroughly naturalized.

Of the plantains, *Plantago minor* is everywhere present in situations affected by this common weed, as gardens, walks and roadsides in sufficiently damp places. *P. lanceolata* is known only from the streets of San Bernardino, where it is abundant in black adobe soil.

A few common weeds of cultivation need only brief enumeration. Such are the Shepherd's Purse, usually the first flower of winter, and the universal Purslane, with the equally prevalent Amaranths, *A. alba* and *A. retroflexa*. In my own neighborhood *A. chlorostachys* is now nearly as abundant, but not many years ago was quite rare, showing that it is a late comer. It is especially troublesome in orchards, germinating after the cultivation is mostly completed, but by autumn attaining a rank growth of eight feet or more. The last two species are thought to be native in Mexico, and there is some uncertainty as to the limit to the north, where they are found only as exotics. Such is undoubtedly their position here, as they are strictly confined to cultivated districts.

With them grows *Chenopodium ambrosioides*, but more frequently in waste places and neglected corners, in which situation it is often accompanied by *C. murale*. In shaded but drier places *Urtica urens* abounds in early spring, often in company with chickweed, *Stellaria media*, both plants growing not only in cultivated neighborhoods but well up in the cañons of the foothills. *Malva borealis* is universal in damp soils, where it grows to great size and luxuriance throughout the year. In a dwarf form it is scarcely less common in drier soils, where it does not outlast the rainy season. The leaves exhibit a distinct heliotropism, which is especially noticeable in the ranker growth. Almost equally abundant in colder soils, especially if slightly alkaline, is the sour clover, *Melilotus Indica*, All.* It has considerable value for pasturage, although not readily eaten by animals when other green forage is obtainable. Water cress, *Nasturtium officinale*, chokes up streams everywhere, even to the mountains and the borders of the deserts, with such abundance and universality as to give color to the doubts that have recently been expressed as to its being an introduced species.

**M. parviflora* Less. of the Bot. Cal.

Polygonum nodosum is often seen in rich damp soil, and still more frequently *P. aviculare* in cultivated grounds and in yards, where no frequent tramping of feet is able to destroy it. Two species of Rumex, *R. conglomeratus* and *R. crispus*, are common in damp soil, in both neglected and cultivated grounds.

THE PAPPUS OF MICROSERIS.

BY T. S. BRANDEGEE.

No botanist seems to have observed that the awns of the pappus of Microseris develop much earlier than the paleæ, but any one having specimens of either *M. linearifolia* Gray or *M. Lindleyi* (DC), with heads in different stages of growth, from bud to maturity, may see that in these two species and probably in all others of a similar structure, the awns have already attained their full length when the flower opens; while the paleæ, then many times shorter, increase gradually in length until the seed is mature, at which time they equal or exceed the awns.

This fact has an important bearing upon several obscure species, founded upon immature specimens and differing from the two mentioned above only in the greater length of the awns as compared with the paleæ.

M. (Calais) macrochæta Gray was described from Oregon, but has since been collected all the way to San Diego. Dr. Gray says, "Mature fruit still unknown."* It is probably young *linearifolia*, to which also belongs, judging by a specimen kindly furnished by Mr. H. C. Ford, the collector, *M. anomala* Watson, Proc. Am. Acad., xxii, 475, and xxiv, 84, where Dr. Watson himself reduces it to *M. macrochæta*.

M. (Calais) Parryi Gray from San Diego, appears, by the character "Scales of the involucre, broader and more blunt [than in *M. macrochæta*], and awn of the pappus shorter and more denticulate,"† to be an immature state of *M. Lindleyi*.

The three other species in this section (*Calocalais* DC.) probably all belong to *Lindleyi*. *Calais Kelloggii*‡ Greene, from the vicinity of San Francisco, is identical with it; *C. Clevelandi*§ Greene,

*Syn. Fl. ii, pt. i, 418.

†Mex. Bound. Surv., ii. 104.

‡Bull. Cal. Acad., ii, 49.

§Bull. Cal. Acad., ii, 49 (under name *C. Parryi*); l. c., ii, 153.

from San Diego (which is probably mature *Parryi*), scarcely differs at all; and *C. pluriseta** Greene, which was described from old seeds picked out of crevices in the ground, may belong to either. The "secondary awnlets" described, are probably the slender, usually unequal tips of the cleft paleæ, which in *Lindleyi* are often of considerable length. Mr. Greene, in a subsequent note,† describes the leaves—which in this group are of comparatively trivial moment—but fails to confirm the previous description of the pappus; and the writer, who spent some weeks subsequently upon Santa Cruz Island and sought carefully for the species, could only find *linearifolia* and *Lindleyi*.

[For "*Gobius Nicholsoni*" page 66, second line from top, substitute "*Gobius Nicholsi*." On page 93, 23d line from top, for "genuine" read "generic."]

RECENT LITERATURE.

The Nautilus, iii, No. 11. A New Species of *Tylodina*, by W. H. Dall. A New American *Bulimulus*, by H. A. Pillsbry. On some Northern Pupidæ (describing six new species), by V. Sterki. On the Generic Position of *Arion foliolatus*, by T. D. A. Cockerell, proposing for it a new generic name, *Phenacrion*. A Few Last Words on *Crepidula*, by John Ford.

West American Scientist, vii, No. 1. C. C. Parry (with portrait), by C. L. Orcutt. Fauna and Flora of Colorado, by T. D. A. Cockerell. A New Locality for *Helix Ayresiana*, by Lorenzo G. Yates. Palmerella, by Edward Palmer. A Handsome Astragalus, by C. C. Parry, suggesting a possible variety *(coccineus)* of *A. Purshii*.

Torrey Bot. Club. Memoirs, i, No. 4. On Seedless Fruits, by E. Lewis Sturtevant, concluding the volume of 186 pages. This is a semi-popular compilation of interesting, but not at all unknown facts relating to the occurrence of seedless varieties in cultivated plants—such a paper, in fact, as we are accustomed to see in agricultural reports.

Garden and Forest, No. 118.—Of interest to American botanists are Notes on North American Trees, xvii, by C. S. Sargent. Notes

*Pitt., i, 34.

†Bull. Cal. Acad., ii, 405.

on American Plants, by F. H. Horsiord. No. 119.—New or Little Known Plants *(Phœnix Rœbelenii)* with fig., by W. Watson. Notes on American Plants, by F. H. Horsford. No. 120.—*Selenipedium caudatum* var. *Warscewiczii*, with fig. Notes on American Plants, by F. H. Horsford. No. 121.—Forests and Irrigation. *Pinus Glabra*, by Carl Mohr. New or Little Known Plants *(Symphoricarpus occidentalis)* with fig., by C. S. Sargent. Notes on American Plants, by F. H. Horsford.

Contributions to North American Euphorbiaceæ, ii, by C. F. Millspaugh. Reprinted from Pittonia, pp. 82–90, with plate. Describes as new *E. pseudoserpyllifolia*, *E. Greenei*, *E. Laredana*, *E. Jonesii* and *E. dentata* var. *gracillima*. The rest of the paper is taken up by an account of *E. serpyllifolia* Pers., to which a number of unpublished species by Engelmann, *E. Neo-Mexicana* Greene and *E. sanguinea* H. & S. as represented by the specimens identified therewith by Mr. Greene in Bull. Cal. Acad., ii, 57, are reduced. The author expresses the hope that this rather full description of forms "may render future nomination facile."

PROCEEDINGS OF SOCIETIES.

California Academy of Sciences. *June 2, 1890.* President Harkness in the chair.

Mr. Townshend S. Brandegee gave an interesting account of his recent botanizing trip to Santa Catalina Island. He described briefly its climate and topographical features, and its most striking and interesting plants. A fine photograph was shown of the Bay of Avalon, which is becoming a favorite summer resort for people from the adjacent mainland. Upon the island there are about 12,000 sheep and perhaps 10,000 goats. Visitors are permitted to hunt the latter as they are not desired by the owners and are diminishing the food supply of the sheep.

June 16, 1890. President Harkness in the chair.

Dr. H. Carrington Bolton, who had recently returned from the Hawaiian Islands, exhibited a quantity of sonorous sand which he had collected there during his visit, and produced from it the characteristic sound.

Dr. Carl Lumholtz gave an interesting account of his residence of two years among the cannibals of Australia. He stated that the aborigines of that country were probably the lowest of the human species. In no way in advance of the stone age, the cannibal instinct is strong within them. Having made himself acquainted with their language, the Doctor lived with them, subsisting upon such food as the natives used, while moving about from place to place as is their habit. Many interesting facts were brought out during the lecture which was profusely illustrated.

PLATE IV.

PLATE V.

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